Enclosure
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REGULATORY APPROVAL FOR SOLAR POND CLEANOUT STRATEGY

Enclosed is documentation defining the specific steps, processes, and equipment to be used for executing the strategy proposed at the Colorado Department of Health briefing of March 17, 1992. This information also includes block flow diagrams and brief descriptions of the Halliburton-NUS pond sludge chemical solidification and stabilization (CSS) processes. A request for change to interim status for these CSS processes will be submitted in the near future. The process train for the A and B Pond sludges will be installed and operated in an area south of the 207A Pond. The process train for C Pond sludge and the clarifier contents will be located on the 750 Pad.

The regulatory guidance received during the briefing has been incorporated into the overall processing strategy. All necessary precautions have been considered to assure that the plan does not violate the intent of any applicable regulation or previous compliance agreement. Additionally, the strategy is consistent with proposed Environmental Protection Agency guidance on the corrective action management unit concept for remedying an environmental problem.

In-situ chlorination, which is currently planned for the B-series ponds, requires the use of gaseous chlorine rather than solid calcium hypochlorite. Chlorine gas presents significantly more operating problems and poses a much higher potential risk to operating personnel. Therefore, additional information is enclosed in the documentation to justify the use of a tank treatment process with controlled residence time for chlorination of the B-series pond sludges.

Permission is requested at your earliest convenience for initiating the processing steps prior to CSS of the sludges as described in Section 3.0 of the enclosed documentation. If there are any questions, or additional information is required, please contact Don Ferrier at extension 8957.

Enclosure:
As Stated

cc:
P. W. Edrich - EG&G Rocky Flats, Inc.
D. R. Ferrier - " "
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1.0 INTRODUCTION

The intent of this document is to provide technical information and supporting documentation necessary to define the overall strategy/processing steps identified at the regulatory briefing of March 17, 1992 with the Colorado Department of Health (CDH). The following information is presented for each of the proposed steps in the overall processing strategy:

1. The technical justification or rationale for each step.

2. Special considerations or performance standards necessary to execute the step.

3. Process diagrams showing generalized arrangement of all piping and processing equipment.

4. Potential regulatory issues.

Generalized diagrams showing configurations of the processes and/or piping to be used for accomplishing the proposed steps are included as attachments. Additional technical information in support of the overall strategy is also attached.

2.0 OVERVIEW

The 207 Pond Area contains 5 Solar Ponds that contain water and sediments. The A and B Ponds will be consolidated and the sludges will be dewatered prior to chemical stabilization and solidification (CSS). The entire C Pond and Clarifier contents will undergo CSS without a dewatering step.

Three different waste forms require CSS treatment within the pond area: A and B Pond Sludges, C Pond, and the Clarifier. The C Pond and Clarifier will be processed in the C Pond Process Train while A and B Pond Sludges will be processed in the A/B Pond Process Train.

HNUS will perform chemical stabilization and solidification (CSS) of all pond sludges, clarifier sludges, and residual pond waters. The CSS process for Pond 207C and the clarifier wastes will be located on the 750 pad. The CSS process for pond 207A and the three B-series ponds will be located in an area south of pond 207A. Each of these two units can work independently of the other. ATTACHMENT 1 shows the location of the processing equipment.

HNUS will pump the 207A pond sludge and water to the 207B-Series ponds as the first step in the overall process. The next step is to consolidate and chlorinate the waste sludges within the B-Series ponds. Chlorination of the sludges is necessary to destroy pathogens known to be present and improve the dewatering rate of the sludges prior to CSS processing. The consolidation and densification operation dredges sludge consisting of 5-10% solids from Ponds 207B-South and 207B-Center, dewaters the sludge to 10-20% solids and deposits the sludge into Pond 207B-South. The consolidation step and transfer process will also tend to homogenize the sludges prior to their final destination in 207B-South. Consolidation of the sludges into Pond 207B-South substantially improves CSS process control.

The CSS process for Pond 207C and the clarifier tank requires no dewatering steps . The waste sludges will be homogenized, chlorinated and processed at a controlled slurry density.

3.0 SUMMARY OF PROCESSING STEPS PRIOR TO CHEMICAL STABILIZATION AND SOLIDIFICATION (CSS) OF SLUDGES

The regulatory guidance received at the March 17, 1992 briefing has been incorporated into the processing strategy. The essential steps prior to CSS processing and the sequence of operations within each step are summarized as follows:

3.1 207 A/B Ponds Waste Processing

Step 1 - Transfer 207A Pond sludge/water into the 207B-Series ponds.

Step 2 - Temporarily divert interceptor trench water from Pond 207B-North to Pond 207A.

Step 3 - Pre-treat and consolidate B-Series sludges into 207B-South Pond according to the following sequence of operations:

a. Evaporate water to a point where the volumes of material in the B-Series Ponds can be held in two (2) ponds. Maximum storage capacity of any two B-Series Ponds is 3.2 million gallons of water and sludge.

b. Transfer water and sludge from B-North into two (2) remaining B-Series Ponds. B-North can then be considered empty for processing purposes.

c. Chlorinate the Center & South Pond using an in-situ process.

d. After sludge settling, decant waters from B-Center and B-South to the North Pond. Continue to evaporate water in the North pond.

e. Transfer contents of B-Center into B-South.

f. Decant water from B-South Pond to B-North

g. Transfer consolidated sludge from 207B-South into HNUS processing train for CSS. Attachment 2 is a simplified block diagram of the CSS process.

3.2 207C Pond Waste Processing

Step 1 - Homogenize 207C Pond contents within the pond and pre-treat the slurry enroute to CSS processing according to the following sequence of operations:

a. Dissolve/size reduce sludge crystals.

b. Pump homogenized slurry from pond into process train and separate oversized particles.

c. Chlorinate the size-reduced slurry in the processing train.

d. Transfer slurry to averaging tanks.

e. Average the percent solids in the slurry for CSS processing. Attachment 3 is a simplified block diagram of the CSS process.

3.3 Clarifier Sludge Waste Processing

Step 1 - Chlorinate the Clarifier contents and blend with C-pond waste enroute to CSS processing according to the following sequence of operation:

a. In-situ chlorination of the Clarifier contents.

b. Pump waste from top of tank into process train. Blend with C-pond waste within the process to achieve a 20-25% waste loading of clarifier to C-pond slurry at mixing location.

c. Transfer blended Clarifier and C-pond slurry for CSS processing.

4.0 DESCRIPTION OF SPECIFIC PROCESSING STEPS FOR 207 A/B PONDS

4.1 Step 1 - Transfer 207A Pond Sludge/Water into the 207B-Series Ponds

4.1.1 Technical Justification

The sludge and water in Pond 207A originated from emergency transfer of waste materials from the B-Series ponds. All waste characterization results indicate that the ponds are similar in composition and chemically compatible. Pond waters do not exceed LDR limits. Pond sludges in 207A, 207B-North, and 207B-Center exceed LDR limits for cadmium only.

Treatability testing results show that the CSS approach is identical for the material in Pond 207A and the 207B-Series ponds. No constituents are present in the sludges to inhibit CSS individually or after consolidation.

Consolidation of the sludges as the initial step in the process will provide better process control during the CSS process. REFERENCE 1 summarizes the information to justify consolidation of the 207A and B-series pond sludges.

4.1.2 Special Considerations/Performance Standards

Water and sludge transfer from Pond 207A to the B-Series ponds will be done as expeditiously as possible. No pre-conditioning or pretreatment of the A pond will be done prior to consolidation.

4.1.3 Process Diagrams/Description

ATTACHMENT 4 shows the generalized configuration of the piping to be used for mass transfer of material from Pond 207A to the B-Series ponds.

Pond 207A currently contains about 1,000,000 gallons of water and approximately 20 cubic yards of sludge located in the sump area in the northeast corner. Initially a 2000 gpm centrifugal pump will be used to pump the majority of the water. After the majority of the water is removed, a submersible vacuum pump will be used to transfer the sludges from the sump area into the B-Series Ponds. Double contained pipe will be used where the pipeline routing is outside of the pond berm. A steel pipe (4-6 inch diameter) with vitaulic couplings will be used during the transfer of the water and residue sludge.

Washdown water will be supplied from the 207B-Series Ponds with a separate pumping system for washdown and removal of residual sludge materials from Pond 207A.

4.1.4 Potential Regulatory Issues

There are no regulatory issues with this transfer. The waste currently in Pond 207A came from the B-Series Ponds. Freeboard on the B-Series ponds will be carefully monitored and kept below the accepted regulatory limit during the transfer process.

4.2 Step 2 - Temporarily Divert Interceptor Trench Water From Pond 207B-North to Pond 207A.

4.2.1 Technical Justification

The overall integrated solar pond cleanout project plan contains two basic processes for the A and B series ponds.

1. Removal and treatment of pond water,

2. Followed by removal and processing of the sludge.

Interceptor trench water must be diverted from the 207B-Series Ponds to create a static condition within the ponds for effective densification of the sludges prior to the CSS process. Densification of the sludges prior to the CSS processing is essential for effective process control. The densification process will produce significantly less final waste volume. The savings to DOE in disposal costs is substantial.

Once interceptor trench water is diverted, water removal can be performed in the 207B-Series through enhanced solar evaporation and forced mechanical evaporation , with reuse of the distillate water in the plant raw water system. Water levels in the 207B-Series ponds can then be reduced sufficiently to allow 207B pond consolidation and commencement of the CSS process.

Temporarily diverting the interceptor trench water into Pond 207A is required until the modular surge tanks are installed and operational. The surge tanks are expected to ready within approximately 2-months.

4.2.2 Special Considerations/Performance Standards

All piping necessary to make the transfer of interceptor trench water inflow must be in place. Final piping connections to execute the diversion of water must be done in an expeditious manner to prevent the interceptor trench central sump, which is down-gradient of the ponds, from overflowing.

4.2.3 Process Diagrams/Description

The inflow of interceptor trench water will be diverted by installing a temporary, double contained line from the present point of entry into Pond 207B-North to the northeast corner of Pond

207A. This planned route minimizes the length of the temporary line.

The diversion of Interceptor Trench water will not be done until the 207A Pond contents are transferred to the B-Series pond and the pond is visibly clean of residual sludge and sediment.

4.2.4 Potential Regulatory Issues

The most recent waste characterization data from sampling and analysis of the water at the central sump as well as analysis of the water in the 207B-series ponds indicate that the interceptor trench water is not an LDR waste-water. Water management activities (temporary surge tanks and additional evaporation capacity in 910 Building) are in process to permanently manage the trench water independent of the solar evaporation ponds. In the interim, placement of this water in Pond 207A, rather than 207B-North, would not deviate from existing practices.

4.3 Step 3 - Pre-treat and Consolidate the Pond 207B-Series Sludges into Pond 207B South

4.3.1 Technical Justification

Chlorination, dewatering and consolidation of the B-Series sludges into one holding area is necessary for enhanced process control and is justified based on the chemical and physical properties of the sludges. The reduction in final waste volume resulting from the proposed sequence of operations allows the Rocky Flats Plant to remain within existing interim status storage capacities for the 750 and 904 pads. The densification process described will produce significantly reduced final waste volume.

4.3.2 Special Consideration/Performance Standards

There are several considerations involved with executing this step in the overall strategy.

First, the volume of waste material (sludge and water) in the 207B-Series ponds must be less than 3.2 million gallons. This is necessary for sufficient capacity to allow mass transfer of the contents of 207B-North pond into the other two B-Series ponds. No waste pre-treatment is required prior to this transfer.

Second, chlorination to destroy the pathogens and biomass sheath around waste particles is required to permit certification of the CSS waste for disposal at the Nevada Test Site (NTS). Additionally, destruction of the biomass sheath around the waste particles is absolutely necessary to permit volume reduction. This chlorination pre-treatment must be done in-situ to avoid a treatment and placement issue with LDR waste in a surface impoundment undergoing closure.

Chlorination of the wastes also improves the settling rate of the sludges which, in turn, provides a lower total suspended solids (TSS) decant water. Forced evaporation of decant water with a low TSS content will produce less concentrate for CSS treatment. Laboratory testing shows that longer residence time after chlorination enhances all beneficial effects. Chlorination of the waste will be performed after the sludges are contained in the 207B-Center and South ponds. Pond 207B-North will be empty and available for receiving decant water.

Third, decant and filtrate water from the sludge dewatering operation (rotary drum screen) prior to the CSS process will be returned to 207B-North or to 207B-Center for use as wash water. Enhanced solar evaporation or forced mechanical evaporation will be used to process this water with CSS treatment of the concentrate and any residual pond sludges.

4.3.3 Process Diagrams/Description

ATTACHMENT 5 depicts a generalized method for in-situ chlorination of the 207B-Center and South ponds. ATTACHMENT 6 shows the generalized layout for the consolidation of sludges into 207B-South.

To perform the transferring of waters and sludges within the pond areas, conventional pumping equipment will be used. Centrifugal pumps will be used to transfer the majority of the water. Submersible vacuum pumps will be used to transfer the heavier sludges to the South Pond. Steel vitaulic coupled 4-6 inch pipe will be used to convey the sludges to the South Pond.

During pond cleanup, hoses will be used to facilitate consolidating any residues into the low area of the pond for removal. Wash waters will also ensure that sludges are not allowed to dry upon contact with the air. Final cleanup may necessitate manual removal of final pond contents.

4.3.4 Potential Regulatory Issues

The 207B-Series ponds are currently operated under interim status as one RCRA Solid Waste Management unit. Transfer of interceptor trench water between the ponds is done routinely to maintain proper freeboard limits. There are no regulatory impediments to consolidating the B-Series sludges into the 207B-South pond.

Chlorination of the waste sludges is a mandatory requirement. NTS will not accept waste which contains pathogens, infectious wastes or other etiological agents as defined by 49 CFR 173.386 and 42 CFR 72.3. The chlorination process must be implemented in a manner that does not constitute illegal placement of LDR waste into surface impoundment which is undergoing closure. Therefore, an in-situ chlorination method is planned to comply with the regulations.

In-situ treatment is <u>not the preferred technology</u> based on an evaluation of various chlorination methods. From a health and safety perspective (REFERENCE 2) and a process standpoint, the recommended technology for chlorine addition is a sealed contact chamber. A feed system injects calcium hypochlorite crystals into the tank. The flow rate is controlled and measured to ensure that a 30-minute retention time is maintained within the contact chamber. A sampling collection point would be located downstream of the tank for periodic testing of residual chlorine levels.

Over 300 pathogens are identified in the two referenced standards (49 CFR 173.386 and 42 CFR 72.3). It is impractical to analyze the waste to ensure destruction of all 300 pathogens; no single laboratory can perform the required analysis. Furthermore, for the results to be certifiable, the analysis must be performed within a 6-hour holding time. Regulations restricting packaging, shipping and receipt of radioactive and hazardous mixed waste samples make it impossible to comply with the sample holding time.

It is recommended that wastewater treatment standards be adopted for pathogen destruction. These are typically predicated on providing an engineered structure capable of retaining sludges for a minimum period of 30-minutes with the effluent having a minimum of 1-ppm of residual chlorine. This system can be easily designed and monitored to ensure that the entire pond contents has been chlorinated for compliance with NTS requirements. Any in-situ system will be incapable of ensuring that the prescribed contact and retention time has been met. For the in-situ chlorination step to be implemented numerous regulatory issues for analysis, testing and verification would have to be resolved.

There are no problems with returning filtrate water from the CSS settling and densification process to the ponds.

<u>5.0 DESCRIPTION OF SPECIFIC PROCESSING STEP FOR 207C POND</u>

5.1 Step 1 - Homogenize and Pre-treat 207C Pond Contents Within the Pond and Pre-treat Slurry Enroute to CSS Processing

<u>5.1.1 Technical Justification</u>

The entire contents of 207C pond (sludge and water) will be processed without any dewatering step. Homogenization of the silt, crystal and liquid phases of the pond is mandatory for effective process control. Disinfection by chlorination of the homogenized slurry is also required to destroy pathogens known to be present in the sludge.

<u>5.1.2 Special Consideration Performance Standards</u>

Makeup water may need to be added to the pond initially to permit effective homogenization and dissolution of the hard crystalline salt layer. Non-LDR water will be used. Make up water may also need to be added to averaging tanks upstream of the CSS process if the dissolved solids (TDS) are too high for the required process control.

5.1.3 Process Diagrams/Description

Pond 207C currently has a hard crystalline layer above the silts contained in the pond. Laboratory analysis has shown that the crystalline layer can be readily dissolved with water containing low total dissolved solids (TDS). Total dissolved solids of water in the pond increase with water depth. The homogenization plan is to introduce recirculated pond water (low TDS content from near surface) at approximately 20 psi directly above the crystalline layer. The water pressure will dissolve/disaggregate the crystalline layer without disturbing the pond surface or damaging the pond liner. No chemicals will be used during the homogenization step.

Once the hard crystals are broken into manageable pieces, continued recirculation will homogenize silts in the bottom of the pond and mix the waters in the ponds that are believed to be stratified due to different dissolved salt concentrations and varying specific gravities (1.0 - 1.332).

Following in-situ homogenization of materials, a remotely operated suction type pump will pick up materials less than three inches in diameter. The pump will discharge to a trash screen to remove any isolated crystallized areas which have been missed during the in-situ mechanical homogenization process. Residual crystals will be loaded into trash boxes for subsequent processing.

Initially the pumped slurry material which is discharged over the trash screen will be returned to the pond. The purpose is to "turn over" the material prior to preparing the material for processing. After all the material has been "turned over", the trash screen underflow pump will pump the slurry material to a sealed 2100 gallon tank where the material will be normalized for % solids. This material will then be pumped to the chlorine contact chamber.

Calcium hypochlorite will be introduced into a sealed tank for contact with the slurry. A 30-minute retention time will be sufficient to destroy any pathogens within the waste. The chlorinated slurry will then be transferred to averaging tanks for CSS processing.

5.1.4 Potential Regulatory Issues

The total cyanide concentration in the Pond 207C water is above the LDR standard for wastewater. The total cyanide concentration in the sludge is below the LDR standard for non-wastewater. The characterization data for water indicates that the total cyanide concentration ranges from 3.3 to 20 mg/l with an average concentration of 7.7 mg/l. The LDR wastewater standard for total cyanide is 1.2 mg/l for F006 listed wastes, which is applicable for Pond 207C. The processing strategy for C pond is to solidify the entire contents of the pond in a uniform slurry consisting of water and sludge. A slurry density of approximately 20% solids will be used as input to the CSS. The total cyanide concentration in this slurry will be in compliance with the LDR standards for non-waste water. The point of compliance will be the final waste form. TCLP testing of the final waste form for cyanide will be used to confirm compliance with LDR standards.

Testing was conducted to oxidize the cyanide in Pond 207C using calcium hypochlorite, chlorine dioxide, and hydrogen peroxide. The testing was conducted initially on 207C slurry (5 parts water, 1 part crystal, and 1 part silty sludge), however; as the testing progressed, tests were conducted only on the water to conserve quantities of silty sludge and crystal.

Test results, which are summarized in REFERENCE 3, show that the cyanide present in Pond 207C water is extremely resistant to oxidation. Typically, alkaline chlorination is successful in reducing the concentration of cyanide; however, the testing conducted on the 207C water did not significantly reduce the cyanide levels. Oxidation with hydrogen peroxide was also unsuccessful in reducing the levels of cyanide to below the LDR standards. Fenton's reagent, which is a very strong oxidant, was also unable to significantly reduce the cyanide concentration. Although there was significant variability in the analytical results, the data suggests that the oxidizing agents had almost no effect on the cyanide concentration. The reason for this observation is not clear, although it is likely related to the high salt content in the pond and/or the cyanide being complexed with metals.

6.0 DESCRIPTION OF PROCESSING STEP FOR CLARIFIER TANK

6.1 Step 1 - Pre-treat the clarifier contents and blend with 207C Pond waste enroute to CSS processing.

6.1.1 Technical Justification

The contents of the clarifier tank will be processed without any dewatering step. The waste material will be chlorinated in place, reclaimed from the top of the clarifier tank and eventually blended at up to 20-25% waste loading with 207C Pond wastes for final casting. Waste characterization has shown that the clarifier tank wastes and C-pond wastes are similar in regulatory considerations.

6.1.2 Special Consideration/Performance Standards

Clarifier tank waste will be processed within approximately a 2 week period. Blending with 207C Pond wastes will be done within the process equipment en route to the CSS unit. Adequate tankage will exist to store the clarifier materials during the blending with C-pond waste.

6.1.3 Process Diagrams/Description

The chlorination of the Clarifier will be done in-situ. Commercially available calcium hypochlorite will be added from the top of the tank from bags. Due to the small volume of chlorine required, a manual system is acceptable. A submersible vacuum pump will be lowered into the top of the open tank for removal of the sludge. The contents will be pumped into on-site tankage for blending in the processing train with the C-pond Waste.

6.1.4 Potential Regulatory Issues

Wastes from the clarifier tank can not be moved into 207C Pond because this would be an illegal placement of LDR waste into a surface impoundment undergoing closure. However, blending of clarifier tank wastes with C-pond wastes downstream of the pond presents no regulatory problem. Water (both raw water and LDR C-pond water) may be added to the process as necessary for process control and to assist in removal of residual sludges within the Clarifier. Blending of clarifier wastes with C-pond wastes is technically justified since the wastes are similar in regulatory considerations. Processing the clarifier as a separate process would significantly increase the difficulty in maintaining input density control. The clarifier will not require a separate waste certification plan since it will be a component of the C-pond solidified waste.

7.0 DESCRIPTION OF STABILIZATION AND SOLIDIFICATION PROCESSES

7.1 CSS Process for Consolidated Pond 207A and Pond 207B-Series Sludge

The sludge will be consolidated into Pond 207B-South. A water level will be maintained above the sludge level during the reclaiming of the solids from the pond. Sludge removal will be accomplished through a flexible inlet suction located in the northwest corner of the pond. Hoses, operated from the pond bank, will be used to wash the sludges toward the suction inlet.

Sludge removed from the pond will vary in the percent of contained solids. All material will be pumped to a scalping screen before entering the CSS process. Oversize material (plus 10 mesh) and foreign objects will be diverted from the process for separate disposal. Screen underflow will go alternately to Surge Tanks Nos 1 and 2. These tanks will function as gravity settling tanks in order to thicken the sludge prior to the dewatering step. No chemicals will be added at this point in the process.

The gravity settling step will increase the percent solids and minimize the variability of the feed slurry going into the CSS process. The settling tanks will provide a normalizing system within the process. Sludge from the gravity settling tanks is expected to be approximately 10-percent solids. Water from the gravity settling tanks will be re-introduced back to the pond as sludge reclaiming operations continue.

Underflow pumps will be used to transfer thickened sludge from the gravity settling tanks to a Drum Dewatering Screen. A polymer flocculating agent will be used to enhance the dewatering capabilities of the sludges. The flocculent will be blended with the sludge feed to the dewatering screen. Excess water from the dewatering screen will go a dirty water separator. The settled solids from the separator will be recycled back to the drum dewatering screen; the water will go to a process water storage tank for recycling back into the overall CSS process.

Gravity flow will be used to move the dewatered sludge to a Cone Side Surge Tank. Positive displacement pumps will be used to pump dewatered sludge from the surge tank into a mixer. Preblended pozzolan (cement, flyash and lime) will be added to the mixer. Pozzolan addition will be controlled by the percent solids and the flow rate of the dewatered sludge so that the water to pozzolan ratio is maintained within the operating envelope needed to assure certification of the cast waste form. Water used to flush residual feed from the mixers will be sent back to the Dirty Water Separator. ATTACHMENT 7 shows the CSS processing arrangement for the consolidated 207A and 207B-Series pond sludge.

7.2 CSS Process for 207C Pond/Clarifier Tank Sludge

The homogenized 207C Pond sludge/water slurry will be pumped from the pond to a scalping screen. Oversize material (plus 10 mesh) will be diverted from the circuit for separate disposal. Screen underflow will go to Averaging Tank No 1 where the total suspended solids (TSS) will be monitored and lowered to a ceiling value (if needed) with brine addition.

Once the TSS is within limits, the slurry will be advanced to Averaging Tanks Nos 2 and 3, via the Contact Chlorination Chamber. Clarifier sludge will also be pumped into Averaging Tanks Nos 2 and 3 as required, but in a deliberate manner, to make the blend a separate and controlled waste batch. Both TSS and total dissolved solids (TDS) will be monitored. If necessary, the TSS level will be trimmed with further brine addition from Pond 207C, and TDS will be adjusted as required with reclaimed 207B-Series pond water. Following adjustment the slurry will be pumped approximately 1200 feet to the 750 Pad Area in a doubly contained pipeline.

At the 750 Pad Area, the slurry will be delivered to a pair of batch tanks (nos 4 and 5 or nos 5 and 6) which is in the fill mode.

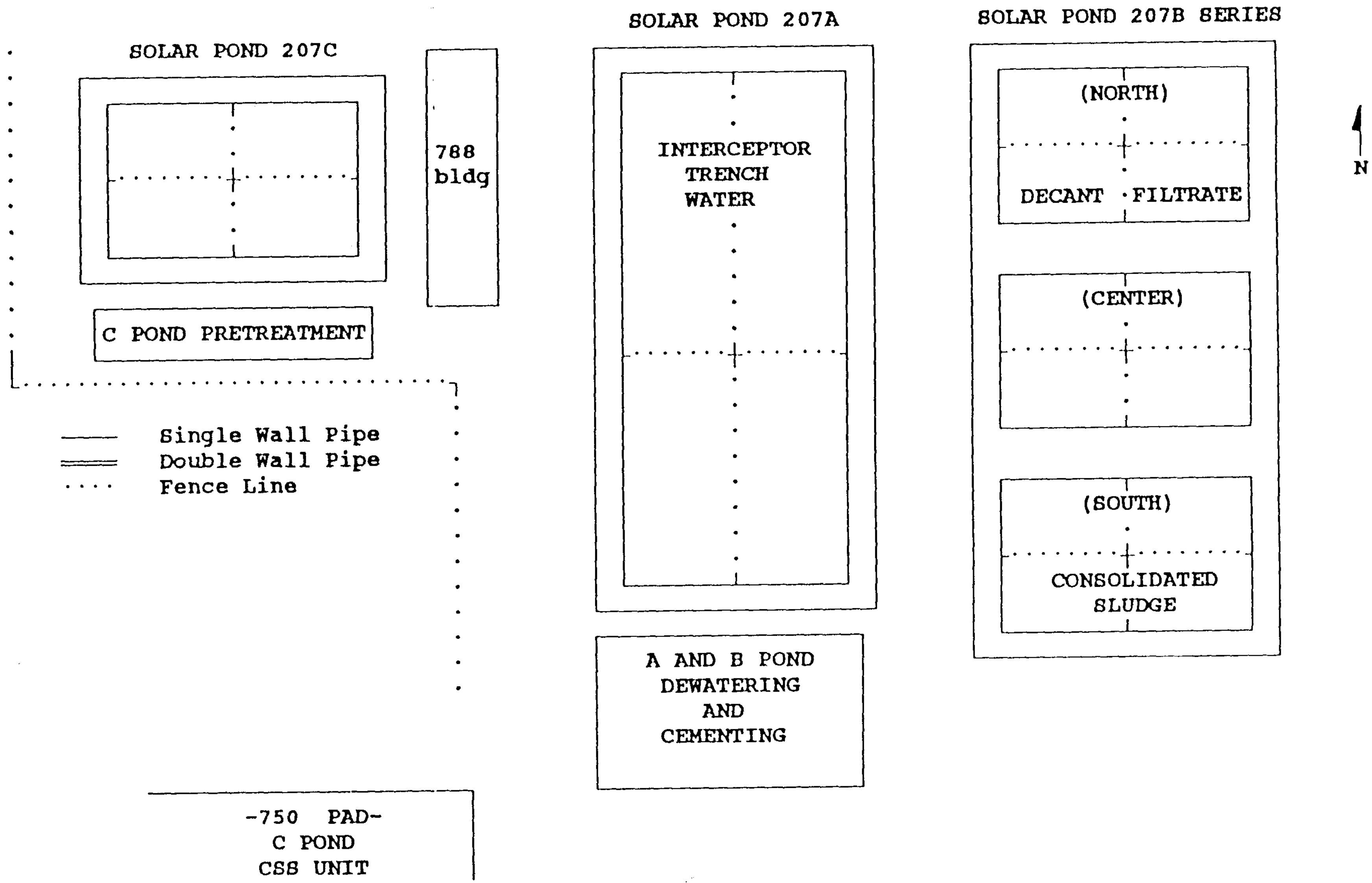
The batch tank contents will be rechecked for TSS/TDS and trimmed with water if required. The water source will be from the flush water system located near the mixing unit.

While one pair of tanks is filling, the other pair of tanks will be feeding properly adjusted slurry to the Recirculating Cement Mixer (RCM). The temperature of the waste feed to the RCM will be maintained between 50 and 100 degrees fahrenheit. Preblended pozzolan (cement, flyash and lime) will be added to the RCM along with the adjusted waste slurry. Pozzolan additions will be controlled by the density and flow rate of the waste slurry so that the water to pozzolan ratio remains within the range of values needed to assure certification of the cast waste form. Once the RCM contents are within the desired range, a casting run will be made. The projected casting rate will fill one half crate every 5 to 10 minutes.

Following the casting run, the RCM will be flushed with water to remove residual feed. The flushed slurry, up to one-half times the RCM volume and piping, will be sent to a dirty water separator via a scalping screen. Oversize material will be diverted for further processing. Suspended solids in the screen underflow settle in the bottom of the dirty water separator and will be pumped back to the pair of batch tanks being filled. The clarified overflow goes to the process water system to provide additional flush water. ATTACHMENT 8 is a block flow diagram which shows the CSS processing system for C pond and the Clarifier.

ATTACHMENT 1

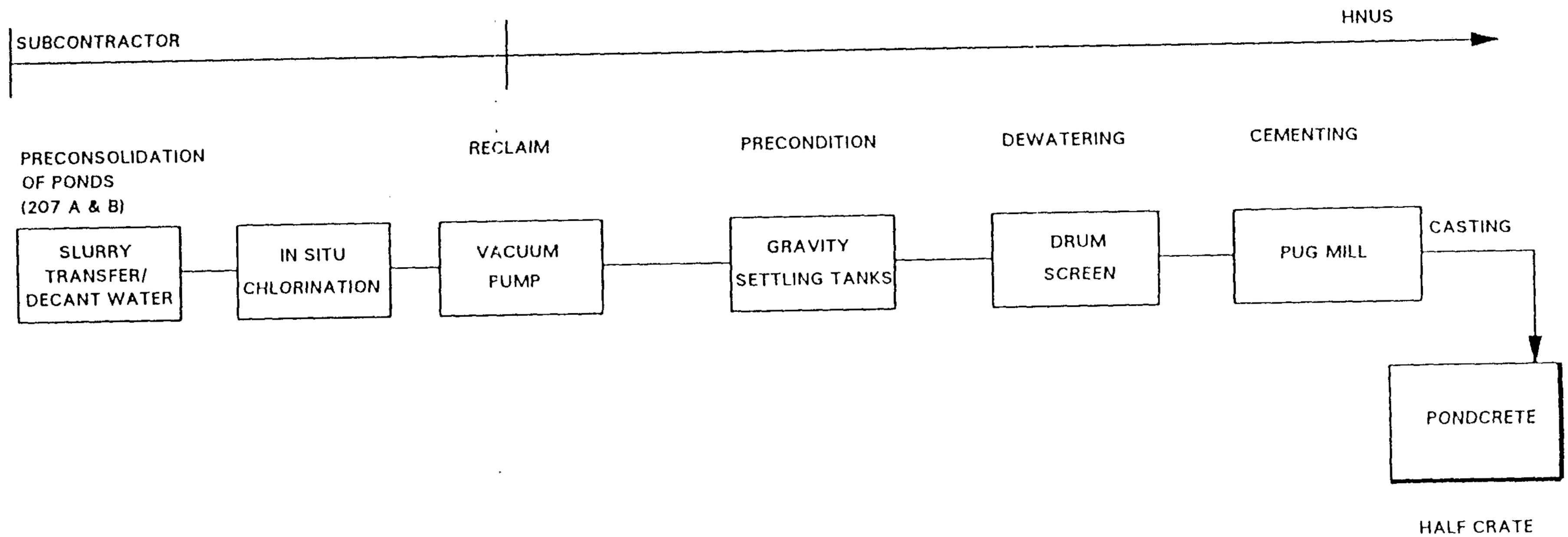
General Location of Processing Streams/Steps For Pond Sludge Processing



ATTACHMENT 2

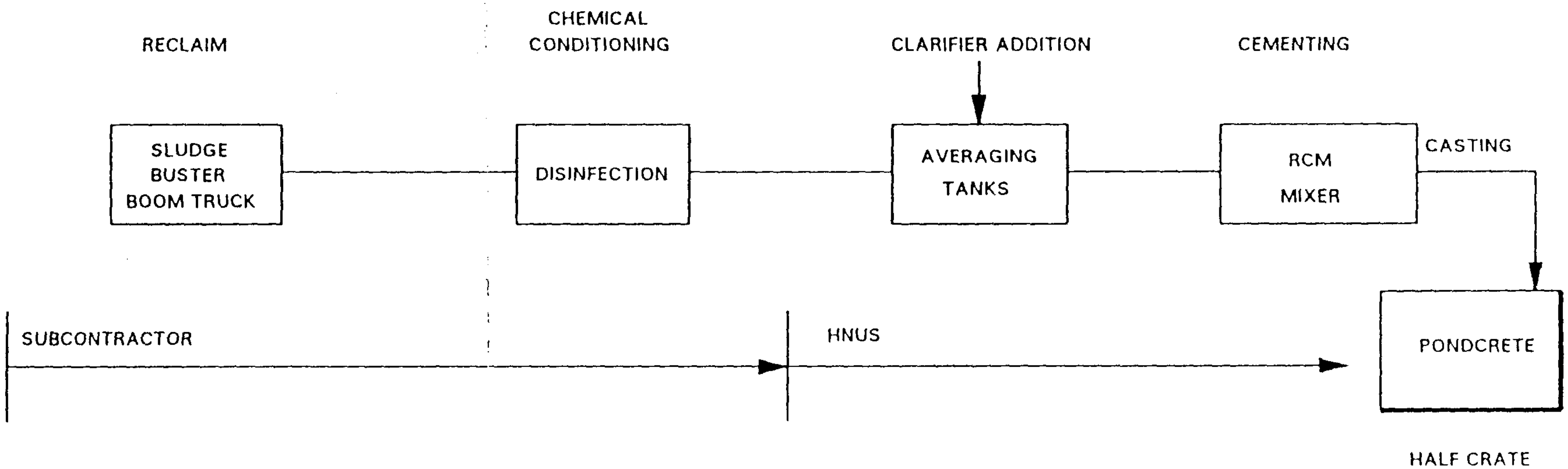
UNIT PROCESSING

PONDS 207 A & B

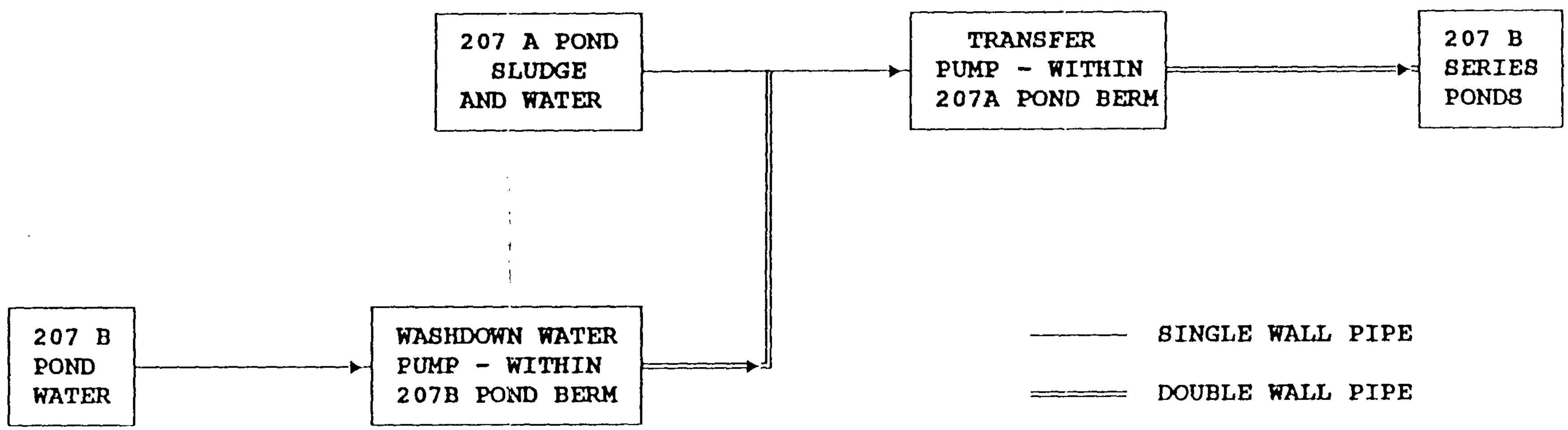


ATTACHMENT 3

PONDS 207 C, CLARIFIER

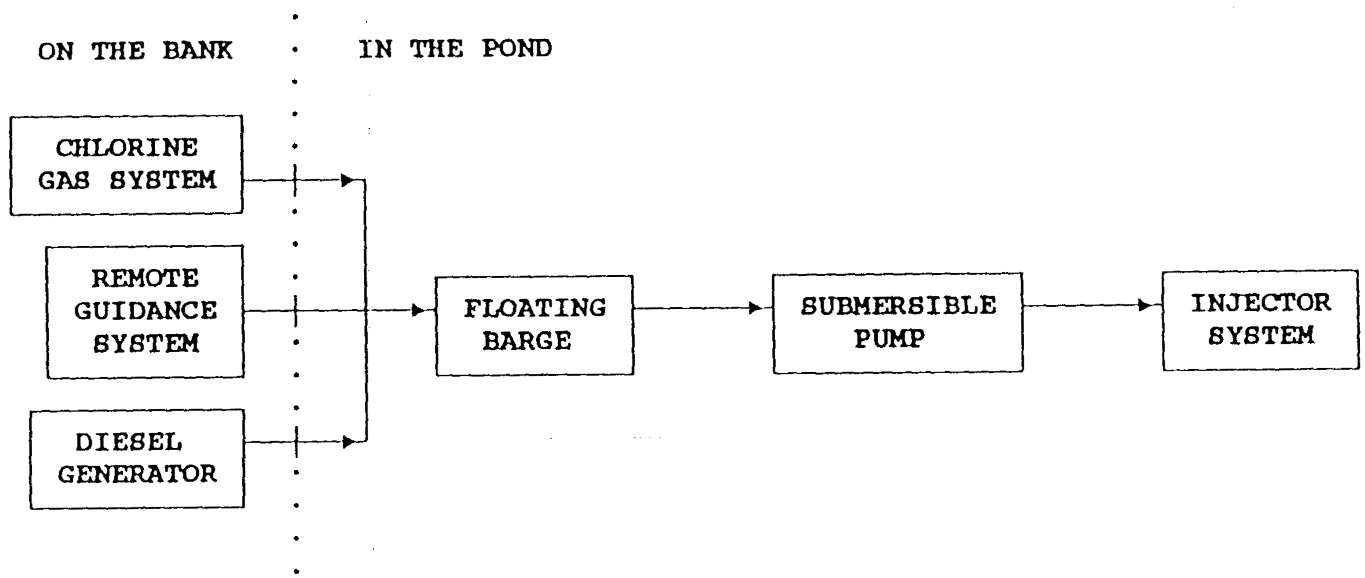


ATTACHMENT 4
Generalized Diagram For Transfering
A Pond Sludge and Water Into The B-Series Ponds

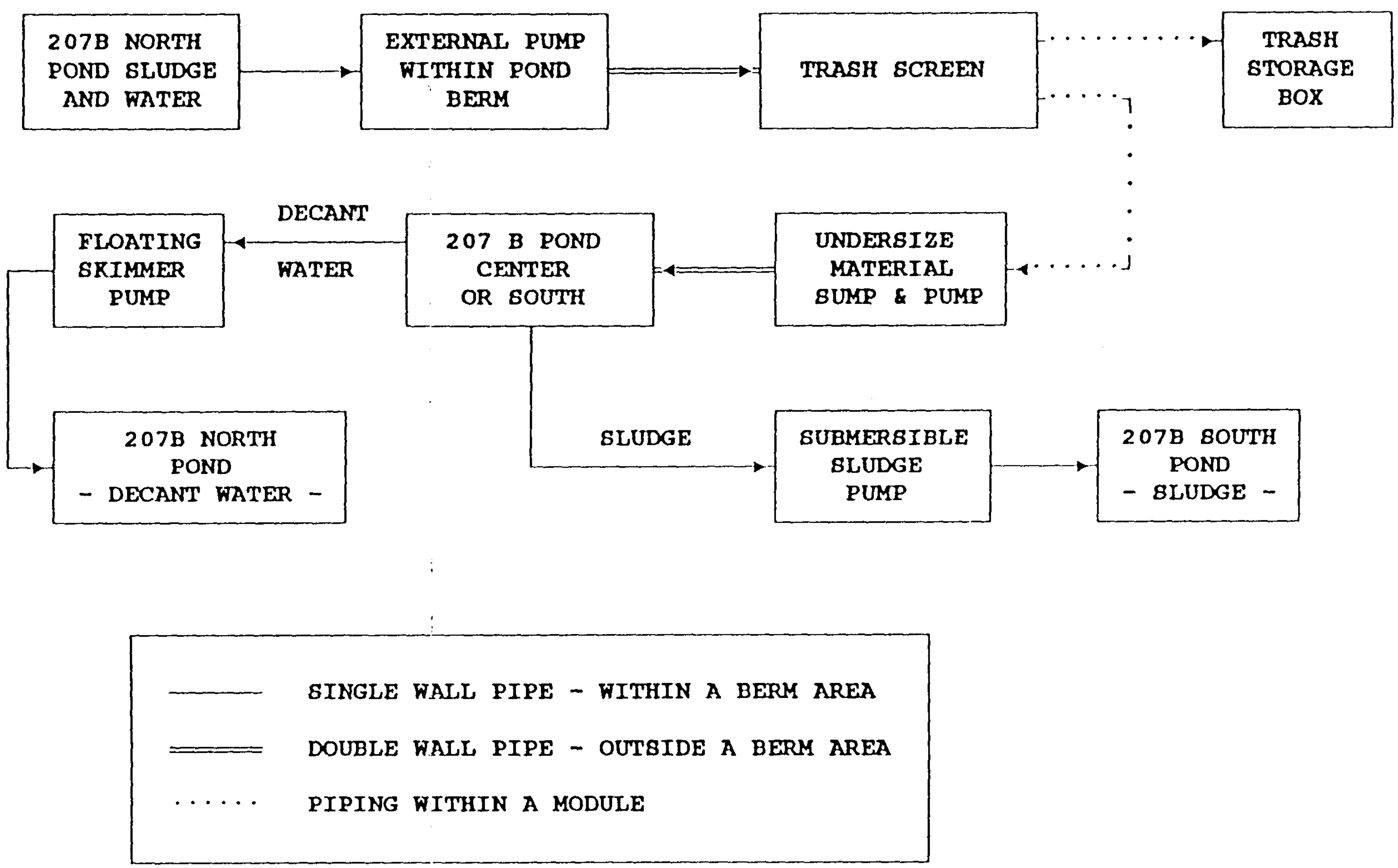


ATTACHMENT 5

Generalized Diagram For The In-Situ Chlorination Process

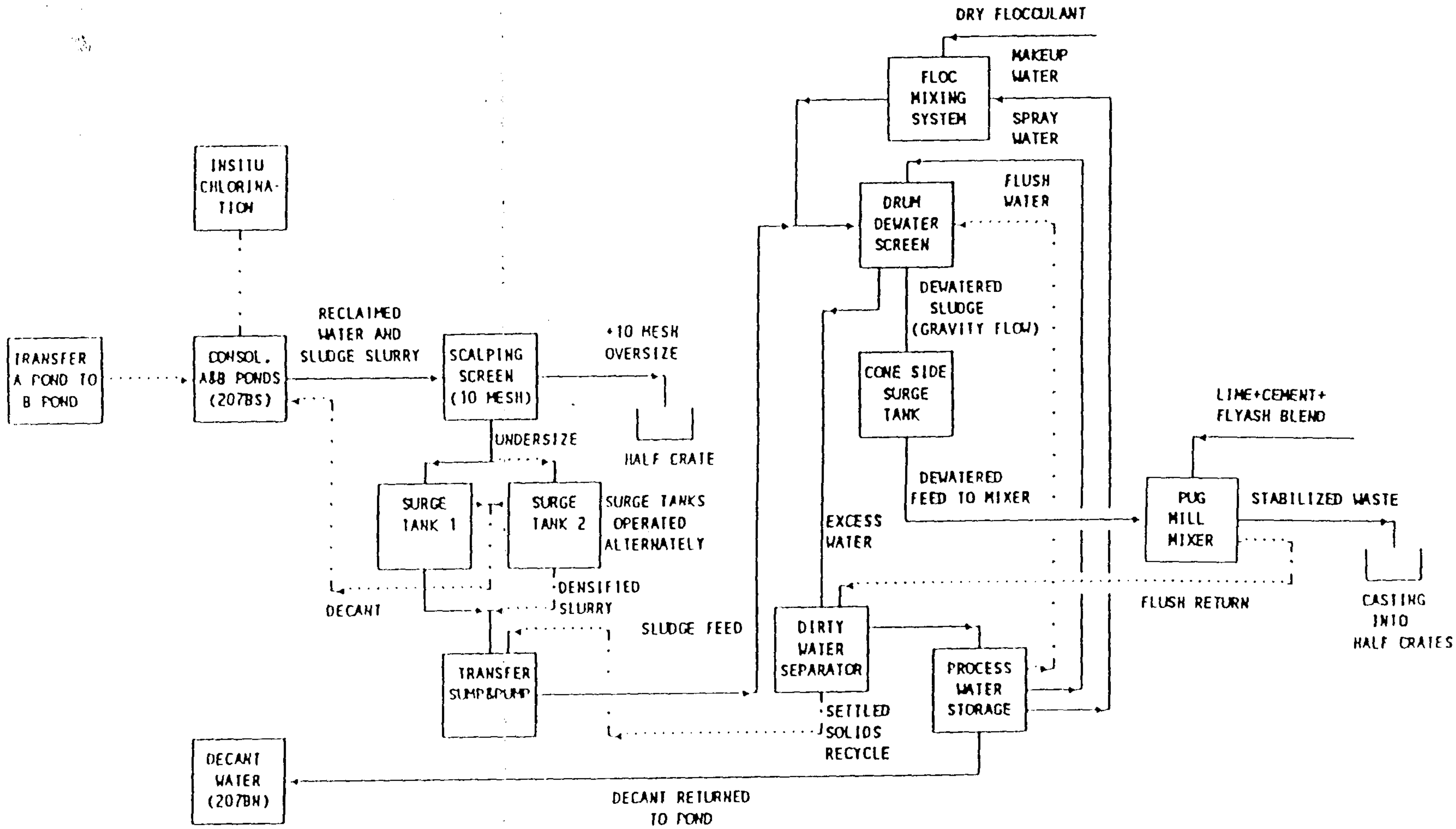


ATTACHMENT 6
Generalized Diagram For Consolidation Of
B-Series Sludges Into Pond 207B-South



ATTACHMENT 7

CONTINUOUS PROCESSING CIRCUIT - SOLIDATED A & B PONDS

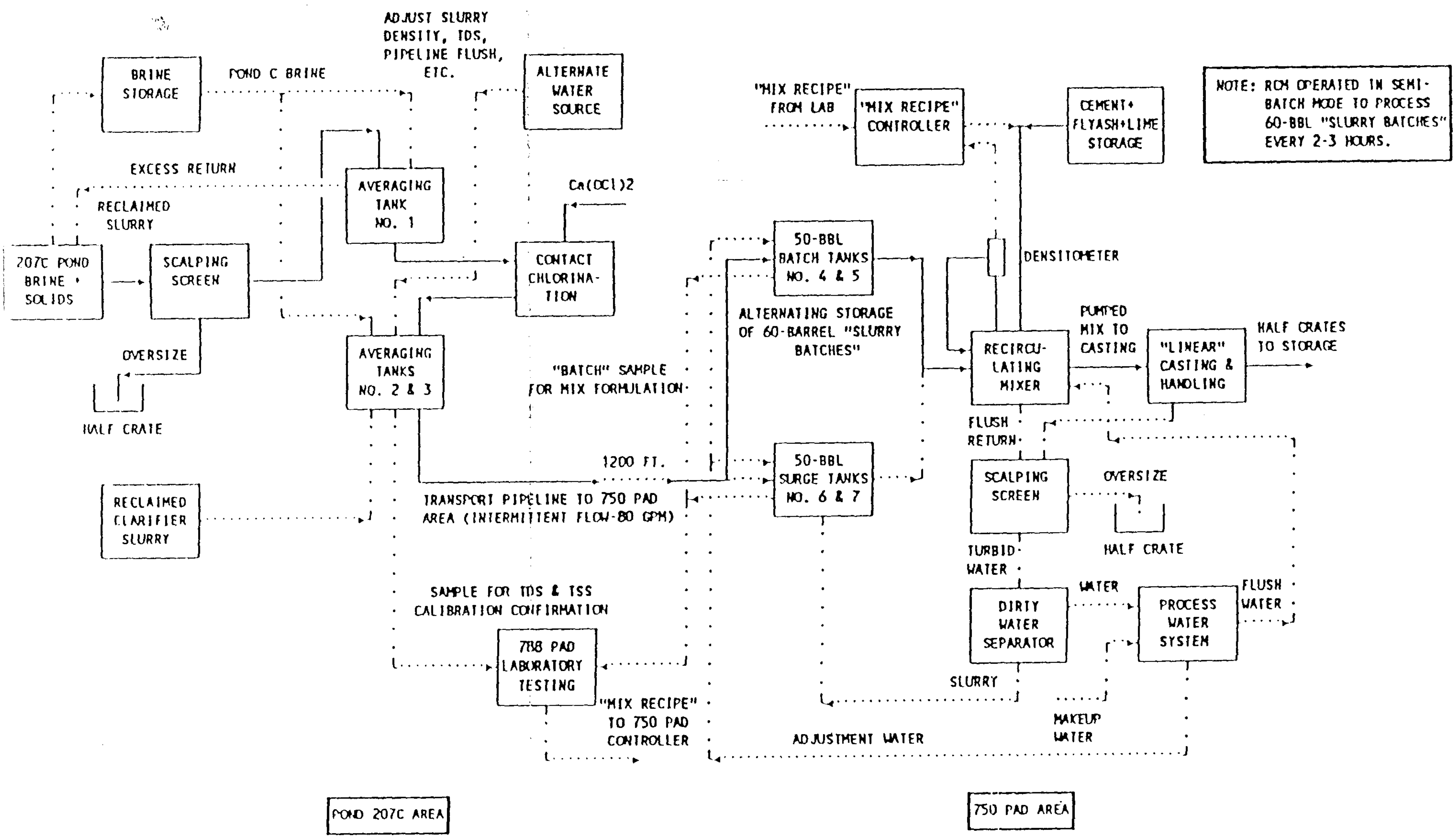


207A AREA

April 13, 1992

ATTACHMENT 8

SEMI-BATCH PROCESSING SCENARIO FOR C-POND AND CLARIFIER



April 13, 1992

To: Ted Bittner
From: J.D. Chiou

Date: January 13, 1992
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Subject: Consolidation of A Pond and B Ponds

This memorandum has been prepared to address the issue of consolidating A Pond sludge with combined B Pond sludge. Based on the quality control and process design/management considerations, it is more efficient to treat the sludge from the 207A pond and the three 207B ponds in a mixed form by the same treatment process than to treat each pond separately by different processes. To obtain the regulatory consent on this approach, it is necessary to show that mixing the materials from these four ponds does not create a chemical hazard (i.e. excessive heat, offgassing, explosion etc.) and/or undesired chemical reactions (i.e. precipitation, pH changes, miscibility problems etc.). Secondly, it must to be shown that the treatment process will be sufficient to handle the mixture. This memo summarizes the facts that are available to support the acceptance of this approach.

In response to the first concern, EG&G and HALLIBURTON NUS have completed chemical compatibility tests and demonstrated that the materials from these ponds produce no abnormal chemical reactions when mixed. Therefore, the only issue left is whether a treatment process can be developed to sufficiently treat the mixture. Successful treatability studies have already been conducted on these four ponds separately by HALLIBURTON NUS which demonstrated that the stabilized sludge can pass LDR and toxicity characteristic standards. Therefore, it is necessary only to show either that all these ponds have similar chemical concentrations or that the resulting concentrations in the mixture will be within the ranges of the original concentrations among the ponds.

Although the physical characteristics, chemicals present and pH values of these four ponds are similar, the ANOVA (ANalysis Of VAriance, which is the general title of methods developed for examining differences between the means of several groups) analyses on the analytical data can not conclude that the mean concentrations of each inorganic among these ponds are statistically the same. This is not a surprising result, considering the different locations/stages of these ponds in the former waste processing operation. Nevertheless, no compounds in the water from any of these ponds exceed either the LDR or toxicity characteristic standards. In the sludge, only cadmium from three ponds (i.e. 207A, 207B-north and 207B-center) exceeds the LDR standard. Clearly, this is a more important factor to be considered in the current stabilization process than the differences between specific chemical concentrations among these ponds. Given the governing criteria of this stabilization process, for all practical purposes, three out of these four ponds (207A, 207B-north, and 207B-center) can be considered similar and an effective treatment can be designed to treat their mixture. For 207B-south which has no compound in the water or sludge that exceeds the LDR or toxicity characteristic standard, the addition of materials from the other three ponds will increase the concentration of cadmium. However, a treatment process based on the worst-case conditions (i.e. higher cadmium concentrations) will still successfully treat this mixture.

The chemical concentrations in the mixture of water or sludge from these four ponds can be estimated by weighted averages of original concentrations in each pond. Using the volumes and specific weights of the sludge in each pond, the following equation can be derived:

$$Cmix = Ca \times 0.055 + Cb\text{-}n \times 0.344 + Cb\text{-}c \times 0.286 + Cb\text{-}s \times 0.315$$

where Cmix is the concentration in the mixture; Ca, Cb-n, Cb-c, and Cb-s are the original concentrations in 207A, 207B-north, 207B-center, and 207B-south, respectively. This equation can be applied to every chemical in the sludge. A similar equation can also be derived for the water. Numerically, Cmix will always be within the range between the maximum and minimum of the original concentrations. For example, the leachable cadmium concentrations in 207A, 207B-north, 207B-center and 207B-south are 485, 73, 136 and 24 ug/l, respectively, and the calculated Cmix is 98.2 ug/l.

In summary, the following conclusions support the acceptance of mixing the water and sludge from these four ponds and treating the mixture by a single treatment process:

- 207A, 207B-north, 207B-center and 207B-south are chemically compatible.
- 207A, 207B-north and 207B-center are the same under the LDR and toxicity characteristic standards.
- 207B-south satisfies both LDR and toxicity characteristic standards for all chemicals.
- Preliminary treatability studies for stabilization of sludges from 207A, 207B-north, 207B-center and 207B-south have been successful, producing a stabilized waste form that passes LDR and toxicity characteristic standards.
- The chemical concentrations in the mixture will be in the range of the original concentrations.
- Better process control can be achieved in a single treatment process for material from a narrower concentration range, such as a homogenous mixture.

These conclusions warrant a treatability study on the combined material from these four ponds.

HAZARDS ASSOCIATED WITH USE OF GASEOUS CHLORINE FOR SOLAR EVAPORATION POND CHLORINATION

From the health and safety perspective, there are many advantages to using a contact chamber for the chlorination of Solar Evaporation Pond (SEP) water and sludge. Use of a contact chamber, for example located on the pond berm, would allow thorough mixing of the SEP materials in a system that could be readily monitored visually during operation. Also, such a contact chamber would enable the use of a chlorination chemical in solid or liquid form. Treatability studies of the SEP materials used powdered calcium hypochlorite. This material posed much less of a hazard than gaseous chlorine.

Alternatively, if a contact chamber unit is not used for chlorination, and instead gaseous chlorine is required for in situ treatment, a number of inherent health and safety problems arise. Engineering evaluations have determined that the SEPs cannot be satisfactorily chlorinated in situ except by the use of gaseous chlorine. Even then, the gaseous chlorine must be intimately distributed throughout the sludge lying at the bottom of the SEPs to ensure proper disinfection for pathogens, and to ensure satisfactory treatment for chemical enhancement of sludge sedimentation.

The result of using gaseous chlorine for in situ treatments means the introduction of a deadly, poisonous gas into the SEP area, and application of this gas underwater in a system that cannot be readily observed visually. Introduction of gaseous chlorine into the SEPs <u>is not</u> similar to swimming pool disinfection. Swimming pools do not have deep accumulations of sludge underneath the water that require thorough mixing and agitation to achieve the intimate contact with chlorine needed for disinfection. In a swimming pool, simple circulation of the water is satisfactory for mixing of the chlorine. Besides, powdered or pelletized chlorinated products are typically used today for swimming pool disinfection.

Even the usage of liquid, powdered or pelletized chlorine compounds may require special health and safety precautions, such as eye protection, face protection, and respiratory protection. Nonetheless, these physical forms are much safer to handle from the health and safety perspective than is gaseous chlorine. If gaseous chlorine is used, the skin and respiratory precautions that will be required become much more complex because of the deadly effects that gaseous chlorine can produce on human skin and lungs. Furthermore, in situ gaseous chlorine treatment of the SEPs will involve more operating personnel time at and on the SEPs increasing the chances of exposure to SEP materials, and to gaseous chlorine. Since specialized personal protective equipment will be needed in the SEP areas, this will also slow down overall operations.

Direct application of gaseous chlorine in the SEPs may result in an increase of chlorine air emissions when compared to use of the enclosed contact chamber with liquid or solid chlorine additives.

Since the threshold limit value for chlorine is only 0.5 ppm, it is desirable to keep emissions of chlorine from the SEPs to a minimum, both from a health and safety, and environmental standpoint.

Considering the inherent acute toxicity of gaseous chlorine, and the problematic technical factors of applying gaseous chlorine aggressively to sludge lying at the bottom of a pond, the use of a contact chamber capable of using a liquid or solid form of chlorine is greatly preferred from a health and safety, and environmental standpoint.

March 26, 1992